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(54) WHITE LAMINATED POLYESTER FILM FOR REFLECTING MEMBER OF SURFACE LIGHT SOURCE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a white laminated polyester film for the reflecting member of a surface light source excellent in reflecting characteristics and hiding performance.
SOLUTION: The white laminated polyester film is obtained by disposing a white polyester layer (A) containing at least inorganic fine particles (a) on one face of a white polyester layer (B) containing fine bubbles and disposing a white polyester layer (C) containing at least inorganic fine particles (c) on the other face of the layer (B). The refractive indexes of the inorganic fine particles (a), the inorganic fine particles (c) and the polyester represented by na, nc and np, respectively, satisfy the relational expressions nc-na>0.2 and nc-np>0.2.

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CLAIMS

[Claim(s)]
[Claim 1] The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing detailed air bubbles. And it is white laminating polyester film with which the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least is carried out to an opposite side, and it grows into it. White laminating polyester film for surface light source reflective members with which the refractive indexes (referred to as na, nc, and np, respectively) of an inorganic system particle (a), an inorganic system particle (c), and polyester are characterized by satisfying the following relational expression (1) and (2).
(1) nc-na>0.2(2) nc-np>0.2 -- [Claim 2] White laminating polyester film for surface light source reflective members according to claim 1 with which the refractive index (referred to as na and np, respectively) of an inorganic system particle (a) and polyester is characterized by satisfying the following relational expression (3) further. (3) -0.3 <=na-np<=0.2 -- [Claim 3] White laminating polyester film for surface light source reflective members according to claim 1 or 2 characterized by the average reflectance of 400-700nm measured from the white polyester layer (A) side being 85% or more.
[Claim 4] White laminating polyester film for surface light source reflective members according to claim 1 to 3 characterized by the optical density of the transparent mode in thickness conversion of 100 micrometers being 0.6 or more.
[Claim 5] White laminating polyester film for surface light source reflective members according to claim 1 to 4 characterized by the content Wa of the inorganic system particle (a) in a white polyester layer (A) and the content Wc of the inorganic system particle (c) in a white polyester layer (C) being 1 - 40 % of the weight.
[Claim 6] White laminating polyester film for surface light source reflective members according to claim 1 to 5 characterized by the ratios (Wc/Wa) of the content Wc of the inorganic system particle (c) to the content Wa of an inorganic system particle (a) being 0.5-10.
[Claim 7] White laminating polyester film for surface light source reflective members according to claim 1 to 6 characterized by the ratios (Tc/Ta) of thickness Tc of a white polyester layer (C) to thickness Ta of a white polyester layer (A) being 0.5-10.
[Claim 8] White laminating polyester film for surface light source reflective members according to claim 1 to 7 with which a white polyester layer (A) is characterized by containing a fluorescent brightener further at least.
[Claim 9] White laminating polyester film for surface light source reflective members according to claim 1 to 8 characterized by for a white polyester layer (B) containing the thermoplastics of immiscible nature, and changing to polyester.
[Claim 10] White laminating polyester film for surface light source reflective members according to claim 9 characterized by the thermoplastics of immiscible nature being polyolefin resin to polyester.
[Claim 11] White laminating polyester film for surface light source reflective members according to claim 1 to 10 characterized by a white polyester layer (A) front face turning into a light reflex side in case it is used as a surface light source reflective member.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to white laminating polyester film. Furthermore, when the surface light source of a side light (it is also called edge light) method is used as the light source for liquid crystal screens in detail, it is the reflecting plate which is a reflective member for these surface light sources, and the white laminating polyester film optimal as a reflector, and it is more bright and is related with the white laminating polyester film for surface light source reflective members which can obtain the liquid crystal screen excellent in the effectiveness of lighting.
[0002]
[Description of the Prior Art] the lighting of a liquid crystal screen etc. -- an appliance -- although the plate-like surface light source was generally used as material, the back light method was conventionally adopted as this surface light source. However, in recent years, the surface light source of a side light method as shown in JP,63-62104,A is widely used from having the merit that it can illuminate to homogeneity with a thin shape. A side light method is a method which applies the light from sources of the illumination light, such as a cold cathode-ray tube, from the edge (edge) of transparency base materials, such as an acrylic board with which halftone dot printing was performed to one side, and it is also called the alias name edge light method. By this method, it prevents that the light from the source of the illumination light escapes to the perimeter of the surface light source, and more, in the transfer loss of light, a reflector is formed in a reflecting plate at the tooth-back side of the surface light source, and is formed in the perimeter of the source of the illumination light at the pan in order to illuminate a liquid crystal screen more efficiently few. Both this reflecting plate and a reflector have a light reflex function, and, henceforth, name both a "surface light source reflective member" generically.
[0003] An example of equipment structure using the surface light source of a side light method is shown in drawing 1 . In drawing 1 , the diffusion plate 14 and the liquid crystal screen 13 are established in one side (halftone dot printing side) of the transparence light guide plate 15 which consists of a transparency base material with which halftone dot printing 16 was performed to one side at a reflecting plate 11 and another side side, and the cold cathode-ray tube 17 is further arranged as a source of the illumination light at the edge of the transparence light guide plate 15. Moreover, a reflector 12 is formed in the perimeter of the cold cathode-ray tube 17. The above is the outline of the equipment structure of a side light method, and explains radical Motohara ** of this method below. Directly, it is reflected by the reflector 12 and the light from the cold cathode-ray tube 17 is introduced into the edge of the transparence light guide plate 15 as incident light. Homogeneity distributes by the halftone dot printing 16, and this incident light is reflected by the reflecting plate 11. And again, this reflected light passes along the transparence light guide plate 15, and compares the liquid crystal screen 13 with homogeneity brightly by being further spread with the diffusion plate 14.
[0004] By the side light method, since the source of the illumination light is installed in the edge side of the surface light source, there are the big features of being made to a thin shape rather

than the back light method with which this source of the illumination light is installed in a tooth-back side.
[0005] Since the high reflection property of thinness and light is required in the first place, a white color and white pigments are added in the above-mentioned surface light source reflective member, or the white film which raised the reflection property of light by the approach of making air bubbles more detailed than before contain etc. has been used for it. Especially reflection of the light by air bubbles is excellent in the point which there is no absorption of light fundamentally, and can compare a liquid crystal screen with homogeneity that it is brighter and widely since a reflection property is scattered reflection (diffuse reflection). The white film which contains detailed air bubbles at such a point is especially desirable as a surface light source reflective member. As a white film containing above-mentioned detailed air bubbles, what is indicated by JP,6-322153,A, JP,7-118433,A, etc., for example is mentioned.
[0006]
[Problem(s) to be Solved by the Invention] By the way, in addition to the notebook sized personal computer from the former, the application of a liquid crystal screen is adopted as various devices, such as a display of the personal computer and television of a deferment mold, and a cellular phone, in recent years, and need is growing quickly. On the other hand, in connection with a higher definition thing being called for, amelioration which increases the brightness of a liquid crystal screen and makes an image clearer more legible is advanced, and the image of a liquid crystal screen is also becoming the thing of source of illumination light (for example, cold cathode-ray tube) nearby quantity brightness, and high power. However, when the above-mentioned film is used as the reflecting plate which is a surface light source reflective member, or a reflector, since it is inferior to concealment nature, a part of light of the source of the illumination light penetrates to an opposite side, the brightness (brightness) of a liquid crystal screen becomes inadequate, or the problem of the effectiveness of lighting falling by the transfer loss of the light from the source of the illumination light is pointed out, and the concealment disposition top of a white film is called for strongly.
[0007] For example, in order to make concealment nature improve, when you were going to make it contain detailed air bubbles and white pigments so much, there was a problem that a film tear occurs frequently, film production nature fell greatly or the trouble at the time of post processing, such as powder generating, became easy to arise, at the time of extension. Moreover, even if the film was obtained, air bubbles connected, it was hard to change, or white pigments became detailed air bubbles with floc, and there was also a problem of on the contrary becoming easy for a reflection property to fall.
[0008] This invention solves the above troubles, holds lightweight nature and an advanced reflection property, and aims at offering the white laminating polyester film for surface light source reflective members which has the concealment nature which was moreover excellent.
[0009]
[Means for Solving the Problem] The white laminating polyester film for surface light source reflective members of this invention for attaining this purpose The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing detailed air bubbles. And it is white laminating polyester film with which the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least is carried out to an opposite side, and it grows into it. An inorganic system particle (a), an inorganic system particle (c), and the refractive indexes (referred to as na, nc, and np, respectively) of polyester are characterized by satisfying the following relational expression (1) and (2).
(1) nc-na>0.2(2) nc-np> 0.2 [0010]
[Embodiment of the Invention] In this invention, as dicarboxylic acid, polyester is represented with a terephthalic acid, isophthalic acid, a phthalic acid, naphthalene dicarboxylic acid, an adipic acid, a sebacic acid, etc., and it is the polymer obtained from diol and dicarboxylic acid by condensation polymerization, and it is [diol is represented with ethylene glycol, a trimethylene glycol, tetramethylene glycol, cyclohexane dimethanol, etc., and] a thing. Specifically, polyethylene terephthalate, polyethylene-p-oxybenzoate, Polly 1, 4-cyclo hexylene dimethylene

terephthalate, polyethylene -2, 6-naphthalene dicarboxy rate (polyethylenenaphthalate), etc. can be used.

[0011] Of course, these polyester may be gay polyester, or may be copoly ester, and dicarboxylic acid components, such as diol components, such as a diethylene glycol, neopentyl glycol, and a polyalkylene glycol, an adipic acid, a sebacic acid, a phthalic acid, isophthalic acid, 2, 6-naphthalene dicarboxylic acid, and 5-sodium sulfoisophtharate, can be used for it as a copolymerization component, for example. Moreover, in this polyester, a proper additive, for example, a heat-resistant stabilizer, an anti-oxidation stabilizer, an ultraviolet ray absorbent, UV stabilizer, an organic easy lubricating agent, an organic system particle, a bulking agent, an antistatic agent, the nucleating additive, the color, the dispersant, the coupling agent, etc. may be blended in the amount by which the effectiveness of this invention is not spoiled if needed.

[0012] As polyester used for this invention, since polyethylene terephthalate and polyethylenenaphthalate are excellent in a water resisting property, endurance, chemical resistance, etc., it is especially desirable.

[0013] The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing air bubbles with the detailed white laminating polyester film of this invention. And it is the configuration (A/B/C) that the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least in an opposite side was carried out. It is required for an inorganic system particle (a), an inorganic system particle (c), and the refractive indexes (referred to as na, nc, and np, respectively) of polyester to satisfy the following relational expression (1) and (2) furthermore.

(1) nc-na>0.2(2) nc-np>0.2 -- as mentioned above, although it is necessary in this invention to make the difference (nc-na) of the refractive index of an inorganic system particle (c) and an inorganic system particle (a) larger than 0.2, it is most desirable to carry out to 0.25 or more and further 0.3 or more more preferably. When (nc-na) is 0.2 or less, either the reflection property of a film or concealment nature and its both may fall, and the brightness of a liquid crystal screen and the effectiveness of lighting may fall as a result. In addition, although especially the upper limit of (nc-na) is not limited, it is about two substantially and is about 1.8 more preferably.

[0014] Moreover, in this invention, although it is necessary to make the difference (nc-np) of the refractive index of an inorganic system particle (c) and polyester larger than 0.2, it is most desirable to carry out to 0.22 or more and further 0.25 or more more preferably. When (nc-np) is 0.2 or less, it is in the inclination for the concealment nature of a film to fall and for the effectiveness of the lighting of a liquid crystal screen to fall as a result. In addition, although especially the upper limit of (nc-np) is not limited, it is about two substantially and is about 1.8 more preferably.

[0015] That is, the white polyester layer (A) in this invention is a layer which whitened by making an inorganic system particle (a) smaller than that of a refractive-index difference with polyester contain and which was more excellent in the reflection property. On the other hand, a white polyester layer (C) is a layer which whitened by making an inorganic bigger system particle (c) than that of a refractive-index difference with polyester contain and which was more excellent in concealment nature. When both reflection property of the white laminating polyester film of this invention and concealment nature improve remarkably and they use it by considering as such a configuration as surface light source reflective members, such as a surface light source reflecting plate and a reflector, a liquid crystal screen is very bright, an image is more clear, and it is legible, and also the liquid crystal screen excellent also in the effectiveness of lighting without the transfer loss of the light from the source of the illumination light can be obtained.

[0016] Furthermore, in this invention, it is desirable that the refractive index (referred to as na and np, respectively) of an inorganic system particle (a) and polyester satisfies the following relational expression (3) further.

(3) It sets to -0.3 <=na-np<=0.2, i.e., this invention, and is the difference (na-np) of the refractive index of an inorganic system particle (a) and polyester. - It is desirable to consider as within the limits of 0.3-0.2, and it is more preferably most desirable -0.25 to 0.15 and to be further referred to as -0.2-0.1. When (na-np) is outside the above-mentioned range, it is in the inclination for the

reflection property of a film to fall and for the brightness of a liquid crystal screen and the effectiveness of lighting to fall as a result.
[0017] Next, an example about this inorganic system particle (a) at the time of using polyethylene terephthalate (the refractive index of a film = 1.5-1.7) as polyester and (c) is shown. Of course, it is not limited only to these examples that what is necessary is just the inorganic system particle which fills relational expression (1) and (2) with this invention. Inorganic system particle (a): A calcium carbonate, a magnesium carbonate, a barium carbonate, zinc carbonate, magnesium oxide, a barium sulfate, a calcium sulfate, calcium phosphate, a silica, an alumina, a mica, talc, a kaolin, lithium fluoride, a calcium fluoride, etc. can be used. As a desirable example, a calcium carbonate, a barium sulfate, a silica, and an alumina are used especially. Inorganic system particle (c): Titanium oxide (divided roughly into an anatase mold, a rutile mold, anatase / rutile mixed-crystal mold, an amorphous structured type, etc. by crystal form), zinc sulfide, antimony oxide, a zinc oxide (zinc white), a basic lead carbonate (white lead), a zirconium dioxide, tin oxide, lanthanum oxide, a lead sulfate, cerium oxide, mica titanium, etc. can be used. As a desirable example, titanium oxide, zinc sulfide, a zinc oxide, and cerium oxide are used especially.

[0018] About each of the above-mentioned inorganic system particle (a) and (c), it may be independent, or two or more sorts may be used together. Moreover, as the concomitant use approach, even if it only carries out mixed addition of two or more sorts, the particle presentation itself may be the complex which is two or more sorts of things. Of course, when that from which a refractive index differs is used together, it is required to fill the relational expression (1) of the above [the refractive index at the time of concomitant use] and (2). Moreover, porosity, the hollow porosity of the gestalt, etc. may be special, and in within the limits which does not check the effectiveness of this invention further, in order to make the dispersibility over resin improve, surface treatment may be performed further.
[0019] As for (c), it is desirable that the mean particle diameter in the inside of polyester is an inorganic system particle (a) in this invention, and each is 0.05-3 micrometers, and it is 0.07-1 micrometer more preferably. this mean particle diameter -- the above -- when out of range, since a reflection property may fall with the poor homogeneity dispersibility of the inorganic system particle by condensation etc., or the scattered reflection (diffuse reflection) property in a front face may fall and nonuniformity may occur in the brightness of a liquid crystal screen with the include angle to see, it is not desirable.
[0020] Moreover, although the content Wa of the inorganic system particle (a) in a white polyester layer (A) and especially the content Wc of the inorganic system particle (c) in a white polyester layer (C) are not limited, its 1 - 40 % of the weight is desirable, and what is in 3 - 35 % of the weight and further 5 - 30% of the weight of within the limits more preferably is the most desirable. When there are few contents Wa and Wc than the above-mentioned range, it is difficult, and raising properties, such as a reflection factor of a film, may produce un-arranging, such as powder generating, in a film tear and the case of post processing at the time of extension, when [than the above-mentioned range] more [conversely].
[0021] moreover, the ratios (Wc/Wa) of the content Wc of an inorganic system particle [on this invention and as opposed to the content Wa of an inorganic system particle (a)] (c) are 0.5-10 -- desirable -- more -- desirable -- 0.6-8 -- further -- 0.7-7 are the most desirable. When the above-mentioned ratio is less than 0.5, and the concealment nature of a film becomes inadequate, and it uses as a surface light source reflecting plate member, the effectiveness which illuminates a liquid crystal screen falls and the brightness of a screen tends to become inadequate. On the other hand, when the above-mentioned ratio is larger than 10, the reflection property of a film becomes inadequate, and the brightness of a screen may become inadequate or it may produce un-arranging, such as powder generating, in a film tear and the case of post processing at the time of extension.
[0022] Although considered as the configuration (A/B/C) which the white laminating polyester film of this invention carried out the laminating of the white polyester layer (A) to one side of a white polyester layer (B), and carried out the laminating of the white polyester layer (C) to the opposite side, this white polyester layer (B) needs to consider as the layer which made detailed

air bubbles contain. As an approach of making detailed air bubbles contain, make ** foaming agent contain and it foams with heating at the time of extrusion or film production. Or the approach of making foam by chemical decomposition and forming air bubbles, the approach of adding gas or the vaporizable matter at the time of ** extrusion, ** The thermoplastics (immiscible resin) of immiscible nature is added to polyester, and, generally the approach of generating detailed air bubbles for it one shaft or by carrying out biaxial stretching, the approach of carrying out abundant addition of the inorganic system particle of a cellular plasticity instead of the immiscible resin of ** above, etc. are used. Although which approach may be used as long as it is within the limits of the purpose of this invention, especially use of ** immiscible-from synthetic point resin of lightweight nature etc. is [ease / of adjusting / of the amount of the air bubbles film production nature and the interior are made to contain] still more desirable in the ease of forming of the more detailed and uniform air bubbles of magnitude.

[0023] As for the air bubbles in this invention, it is desirable to say what can contribute to the reflection property (scattered reflection) grant to a film, as mentioned above, and to specifically generate as a nucleus this immiscible resin made to contain in polyester. When the cross section (the thickness direction) of a white polyester layer (B) is observed with a scanning electron microscope (SEM) or a transmission electron microscope (TEM), what has 0.5-25 micrometers of averages of the cross section of a cellular part in 2 is desirable, and that whose further 1-20 micrometers are within the limits of 2 is still more specifically more desirable.

[0024] The immiscible resin as used in the field of this invention is thermoplastics other than polyester, and in order to show immiscible nature to this polyester, in polyester, the effectiveness of distributing in the shape of a particle and making air bubbles form into a film by extension is large. If it states more concretely, in measurement by the well-known approach using a differential scanning calorimeter (DSC) etc., it will be resin with which Tg which is equivalent to this immiscible resin in addition to the glass transition temperature (it abbreviates to Tg henceforth) equivalent to polyester is observed in the system which fused polyester and this thermoplastics.

[0025] As for the melting point of such immiscible resin, it is more desirable than the temperature at the time of being low temperature, and carrying out heat setting of the film and carrying out orientation rather than the melting point of polyester at the time of film production (heat treatment temperature) that it is an elevated temperature. Also in this immiscible resin, polyethylene, polypropylene, polybutene, polyolefin resin like the poly methyl pentene, polystyrene resin, polyacrylate resin, polycarbonate resin, polyacrylonitrile resin, polyphenylene sulfide resin, fluororesin, etc. are preferably used from this point. These may be homopolymers, or may be copolymers and may use together two more or more sorts of immiscible resin. Also in these, polyolefin resin, polypropylene with especially small critical surface tension, and the poly methyl pentene are desirable, and the poly methyl pentene is still more desirable. Since [that a surface tension difference with polyester is large and] the melting point is high, this poly methyl pentene has the features that the effectiveness of the cellular formation per content is large, and is especially desirable relatively as immiscible resin.

[0026] Although especially the content of the immiscible resin in a white polyester layer (B) is not limited, its 1 - 35 % of the weight is desirable, and it is most desirable that it is 2 - 30 % of the weight and further 3 - 25% of the weight of within the limits more preferably. When there are few contents than the above-mentioned range, it is difficult to raise a reflection property, concealment nature, etc. of a film, and when [than the above-mentioned range] more [conversely], at the time of extension, it becomes easy to produce a film tear etc. and productivity may fall.

[0027] In this invention, since the diameter of distribution of immiscible resin can become small, as a result-izing of the air bubbles generated by extension can be carried out [detailed] more and the reflection property of a film can be raised as a result, it is more desirable to make above-mentioned polyester and immiscible resin contain a dispersant further. The polymer of an olefin system which had polar groups, such as a carboxyl group and an epoxy group, polyester, and a functional group with reactivity as a dispersant in which the above-mentioned effectiveness is shown or a copolymer, a polyalkylene glycol, a surfactant, heat adhesive

property resin, etc. can be used. Of course, these may be independent or may use two or more sorts together. As an approach of adding a dispersant, copolymerization-ization of blend-izing which is mixing with polyester, random copolymerization, block copolymerization, etc., etc. is employable. moreover, the part which is both intermediate state — copolymerization — you may be-izing.

[0028] The content of the dispersant in this invention has 0.05 - 10 desirable % of the weight, and it is 0.2 - 5 % of the weight most preferably 0.1 to 7% of the weight. When there are few contents than 0.05 % of the weight, the effectiveness which makes air bubbles detailed is small. Moreover, in [than 10 % of the weight] more, the effectiveness which adds immiscible resin conversely becomes small, and it is easy to generate problems, such as a fall of a reflection property, and a cost rise.

[0029] In order to give a more advanced reflection property to the white laminating polyester film for surface light source reflecting plates in this invention, it is desirable to make a white polyester layer (A) contain a fluorescent brightener further at least.

[0030] The fluorescent brightener used in this invention is a compound which makes white degree promote, without absorbing the ultraviolet rays in sunlight and the artificial light, holding the function to change and radiate this on the visible ray of purple - blue, and reducing the lightness of a high polymer according to the fluorescence operation. As a fluorescent brightener, a trade name "YUBITEKKU" (Ciba-Geigy), "alumnus-1" (Eastman), "TBO" (Sumitomo Seika Chemicals Co., Ltd.), "a cay call" (Nippon Soda Co., Ltd.), a "kaya light" (Nippon Kayaku Co., Ltd.), "RYUKOPUA" EGM (client Japan, Inc.), etc. can be used. Its selection is desirable, although especially a fluorescent brightener may not be limited and may be two or more sorts of concomitant use, and there is little coloring and it does not have a bad influence on resin especially in this invention, while it excels in thermal resistance depending on independence and the case and compatibility with the above-mentioned polyester can improve homogeneity distribution.

[0031] The content of the fluorescent brightener in a white polyester layer (A) or (B) has 0.005 - 1 desirable % of the weight, and its thing in 0.05 - 0.5% of the weight of the range is more desirable. Being hard to acquire sufficient brightening effectiveness, if there are few contents than the above-mentioned range, the thing exceeding the above-mentioned range has problems, such as on the contrary becoming easy for a reflection property and lightfastness to fall, by a fall and coloring of homogeneity dispersibility.

[0032] It is necessary to consider the white laminating polyester film of this invention as the configuration (A/B/C) made the white polyester layer (A) one side of a white polyester layer (B), and made the laminating of the white polyester layer (C) to the opposite side. For example, with the single film film of one layer, when it is going to acquire the effectiveness of this invention, it is easy to generate a film tear, and since film production is unstable, cost becomes high as a result. Then, it becomes possible to satisfy all the required properties as the whole film to use the layer which was more excellent in the reflection property in the white polyester layer (A), the layer which was excellent in a reflection property, lightweight nature, etc. in the white polyester layer (B), and a white polyester layer (C) as the layer which was more excellent in concealment nature.

[0033] Here, in case the white laminating polyester film of this invention is used for surface light source reflective members, such as a surface light source reflecting plate and a reflector, in case a white polyester layer (A) uses for a transparency base material (for example, drawing 1 transparence light guide plate 15) side as a reflector, a white polyester layer (A) is arranged at the source (similarly cold cathode-ray tube 17 in drawing 1) side of the illumination light, and a white polyester layer (A) front face needs to turn into a light reflex side.
 [0034] In this invention, even if the polyester which constitutes each class of a white polyester layer (A), (B), and (C) is the same polyester constituent, it may be a mutually different polyester constituent. When using an especially different polyester constituent (for example, when the polyester with which the polyester used for a white polyester layer (A) is used for a white polyester layer (B) and (C) by polyethylenenaphthalate is polyethylene terephthalate), since the improvement effectiveness, such as lightfastness and rigidity, is acquired, it is more desirable.

[0035] In addition, in this invention, although any of the approach of laminating are sufficient the approach of compound-izing by co-extrusion under melting film production as an approach of carrying out the laminating of a white polyester layer (A), (B), and the (C) respectively, or after producing a film separately, respectively, the former approach is more desirable in respect of cost etc.
[0036] It is desirable that the average reflectance of 400-700nm for which it asked from the white polyester layer (A) side is 85% or more as a reflection property of the white laminating polyester film of this invention, and it is more preferably [90% or more and 92 more% or more of] the most desirable. When the above-mentioned average reflectance is less than 85%, since a reflection property becomes inadequate and it becomes easy to become inadequate [the brightness of a liquid crystal screen], it is not desirable.
[0037] Moreover, as for the white laminating polyester film of this invention, it is desirable that the optical density (O. D) in the transparent mode is 0.6 or more in film thickness conversion of 100 micrometers, and it is most desirable that it is more preferably larger than 0.8 or more and further 1. Although it serves as an index showing concealment nature, since a background is transparent in this optical density being less than 0.6 since the concealment nature of a film is small, and optical density is visible and becomes inadequate [a reflection property], it is not desirable. Moreover, although especially the upper limit of optical density is not limited, if film reinforcement, film production nature, or productivity in the case of making a film add immiscible resin or an inorganic system particle etc. is taken into consideration, it will be about three substantially.
[0038] Moreover, in this invention, it is desirable that the specific gravity of a film is less than [0.4 or more] 1.3, and 1.2 or less [0.45 or more] and 1.1 or less [further 0.5 or more] are more preferably the most desirable. It falls [air bubbles must be made to contain in large quantities for decrease in specific gravity, therefore film reinforcement falls, or it becomes easy to generate a film tear etc. at the time of film production, and / productivity] and is not desirable when specific gravity is smaller than 0.4. Moreover, when specific gravity is 1.3 or more, since the reflection property of a film becomes inadequate, it is not desirable.
[0039] Furthermore, as for the white laminating polyester film of this invention, it is desirable that the glossiness for which it asked from the white polyester layer (A) side is 5 - 70%, and it is most desirable that they are 10 - 60% and further 10 - 50% more preferably. When glossiness is larger than 70%, since the rate of specular reflection may increase among reflection of a film front face, a scattered reflection (diffuse reflection) property may fall and nonuniformity may occur in the brightness of a liquid crystal screen with the include angle to see, it is not desirable. On the other hand, since a lap with a light guide plate may become an ununiformity and nonuniformity may occur in the brightness of a liquid crystal screen as a result when glossiness is less than 5%, and a film front face becomes coarse too much, for example, it considers as the surface light source, it is not desirable.
[0040] In this invention, although not limited, since what is usually in the range of 10-500 micrometers and further 20-300 micrometers is excellent in the reflection property of a surface light source reflecting plate, or the handling nature in respect of practical use, as for especially the thickness of white laminating polyester film, it is desirable. Moreover, the laminating thickness of a white polyester layer (A) and (C) has desirable 1-50 micrometers, and its further 2-30 micrometers are [among these] more desirable. When laminating thickness is thinner than 1 micrometer, glossiness falls, and nonuniformity comes out or it may be hard coming to obtain sufficient reflection property for the brightness of a liquid crystal screen, and concealment nature. On the other hand, when thicker than 50 micrometers, lightweight nature and a reflection property may become inadequate.
[0041] moreover, the ratios (Tc/Ta) of thickness Tc [on the above-mentioned thickness configuration and as opposed to thickness Ta of a white polyester layer (A)] of a white polyester layer (C) are 0.5-10 — desirable — more — desirable — 0.6-8 — further — 0.7-7 are the most desirable. When the above-mentioned ratio is less than 0.5, and the concealment nature of a film becomes inadequate, and it uses as a surface light source reflecting plate member, the effectiveness which illuminates a liquid crystal screen falls and the brightness of a

screen tends to become inadequate. On the other hand, when the above-mentioned ratio is larger than 10, the reflection property of a film may become inadequate on the contrary, and the brightness of a screen may become inadequate.
[0042] Next, although the example is explained about the manufacture approach of the white laminating polyester film of this invention, it is not limited only to this example.
[0043] In the compound film production equipment which has an extruder (A), an extruder (B), and an extruder (C), in order to form a white polyester layer (B), what mixed the chip of immiscible resin which carried out the vacuum drying if needed [the chip and if needed] for polyester which carried out the vacuum drying so that immiscible resin might become 1 - 35 % of the weight is supplied to an extruder (B). Addition of immiscible resin may use what was beforehand made into the master chip. Moreover, in order to carry out the laminating of the white polyester layer (A), after mixing so that an inorganic system particle (a) may become 1 - 40 % of the weight and fully carrying out the vacuum drying of the chip of polyester, and the master chip of an inorganic system particle (a), the extruder (A) heated by 270-300 degrees C is supplied. Furthermore, in order to carry out the laminating of the white polyester layer (C), after mixing so that an inorganic system particle (c) may become 1 - 40 % of the weight and fully carrying out the vacuum drying of the chip of polyester, and the master chip of an inorganic system particle (c), the extruder (C) heated by 270-300 degrees C is supplied. thus, each extruder -- a raw material -- supplying -- T-die compound -- a mouthpiece -- a laminating (A/B/C) is carried out, co-extrusion molding is carried out to the shape of a sheet so that the polymer of an extruder (A) may come to one side of the polymer of an extruder (B) and the polymer of an extruder (C) may come to an opposite side inside, and a melting laminating sheet is obtained.
[0044] Adhesion cooling solidification of this melting laminating sheet is carried out with static electricity by drum lifting cooled by the skin temperature of 10-60 degrees C, and a non-extended laminated film is produced. It leads to the roll group which heated this non-extended laminated film at 70-120 degrees C, extends two to 5 times to a longitudinal direction (a lengthwise direction, i.e., the travelling direction of a film), and cools by the 20-30-degree C roll group.
[0045] Then, it extends two to 5 times in the direction (a longitudinal direction or cross direction) perpendicular to a longitudinal direction in the ambient atmosphere which led to the tenter and was heated at 90-140 degrees C, grasping with a clip the both ends of the film extended to the longitudinal direction.
[0046] Although draw magnification is extended length and horizontally [2 to 5 times as many as this / each], as for the area scale factor (vertical draw magnification x horizontal draw magnification), it is desirable that they are six to 20 times. An area scale factor becomes inadequate [the reflection property of the film obtained as they are less than 6 times], and when 20 times are exceeded conversely, there is an inclination which becomes easy to produce a tear at the time of extension.
[0047] In this way, in order to give the smoothness of the obtained biaxial-stretching laminated film, and dimensional stability, succeedingly, 150-230-degree C heat setting can be performed, it can cool and roll round to a room temperature after cooling slowly to homogeneity within a tenter, and the white laminating polyester film of this invention can be obtained.
[0048] Thus, since especially the white laminating polyester film of obtained this invention is excellent in a reflection property and concealment nature, the surface light source which used this film for the reflecting plate which is a surface light source reflective member, or the reflector can compare a liquid crystal screen with homogeneity brightly, and can also make the image on a screen clear and very legible further at altitude. Moreover, there is no transfer loss of the light from the source of the illumination light, and a liquid crystal screen can be made to illuminate very efficiently. Therefore, the white laminating polyester film of this invention is a film which has the property optimal as a surface light source reflective member.
[0049]
[Methods for Measuring and Evaluating Properties] The characteristic value of this invention is based on the following evaluation approach and a valuation basis.

(1) — refractive-index [of an inorganic system particle and the refractive-index particle of polyester]: — JIS B of K-7142 — according to law (Becke line method), it measured under conditions of the temperature of 23 degrees C, and 65% of relative humidity by making a sodium D line (wavelength of 589nm) into the light source. Moreover, when an anisotropy was in a refractive index, the average of the refractive index of each direction was made into the refractive index of the particle. In addition, generally the melting point and the pyrolysis point of an inorganic system particle are farther [than whenever / stoving temperature / at the time of melting, extension, and heat treatment at the time of polyester film film production] high, and it is that the refractive index of an inorganic system particle does not change after polyester film film production in most cases. The refractive index of polyester: It is JIS about the film formed only from the polyester of the same component. According to A law of K-7142, it measured using the Abbe refractometer 4 form (Product made from ATAGO) by making a sodium D line (wavelength of 589nm) into the light source. At this time, contact liquid used the methylene iodide and measured it under conditions of the temperature of 23 degrees C, and 65% of relative humidity. Moreover, in the case of the biaxially oriented film, the refractive index was measured about three perpendicular directions mutually [a lengthwise direction (longitudinal direction), a longitudinal direction (cross direction), and the thickness direction], and the average of each refractive index was made into the refractive index of the polyester.

[0050] (2) The mean particle diameter of the mean-particle-diameter inorganic system particle of an inorganic system particle carried out cross-section observation, and asked for the white laminating polyester film which was made to contain the particle and was obtained. That is, using transmission electron microscope HU-12 mold (Hitachi Make), expansion observation of the cross-section parts of a white polyester layer (A) and a white polyester layer (C) was increased 3,000 to 200,000 times, and the cross-section photograph was taken. Next, marking of the particle part of this cross-section photograph was carried out, and the image processing was performed for that particle part using Hi-Vision image-analysis processor PIAS-IV (Product made from a Pierced earring), the pitch diameter when converting a total of 100 particles in a measurement visual field into a perfect circle was computed, and it considered as the mean particle diameter of a particle.

(3) the existence of content of air bubbles more detailed than the cross-section photograph which increased the expansion observation of the cross section of the white laminating polyester film which the detailed air bubbles inside a film and a white polyester layer thickness-saw, and was obtained 500 to 5,000 times using the scanning electron microscope S-2100A form (Hitachi Make) was investigated. Moreover, from the cross-section photograph, the thickness lay length of each white polyester layer was measured, and it counted backward from magnifying power, and asked for the thickness of each class. In addition, in asking for the thickness of each class, a total of five cross-section photographs chosen as arbitration from a mutually different measurement visual field were used, and the average was made into the thickness of a white polyester layer.

[0051] (4) The following three-stage evaluations were performed about trouble generating of the film tear at the time of film production nature film production etc. O It was presupposed that it is good.

O : film production is stable and it is film production nature fitness.

**: A film tear sometimes occurs and it is inferior to film production nature.

x: Film tears occur frequently and film production nature is completely a defect.

[0052] (5) the sample sample which cut the specific gravity film into 50mmx60mm magnitude, and obtained it — high precision electronic aerometer SD-120L (product made from Mirage Trade) — using — JIS A of K-7112 — it measured according to law (underwater substitution method). In addition, the Measuring condition was performed at the temperature of 23 degrees C, and 65% of relative humidity.

(6) Use glossiness digital deflection glossmeter UGV-5B (Suga Test Instruments Co., Ltd. make), and it is JIS from a white polyester layer (A) side. It measured according to Z-8741. In addition, the Measuring condition was made into incident angle =60 degree and light-receiving angle =60 degree.

[0053] (7) the white laminating polyester film of average reflectance this invention — a white polyester layer (A) side — a spectrum — using formula color difference meter SE-2000 mold (Nippon Denshoku Industries Co., Ltd. make), according to JISZ-8722, the spectral reflectance of the range of wavelength =400-700nm was measured at intervals of 10nm, and each value was averaged and calculated.
(8) It measured and asked for optical density (O. D) with the transparent mode using the concealment nature optical-density meter TR927 (made in Macbeth). Concealment nature is so high that this value is large.
(9) What performed halftone dot printing to the acrylic board with a thickness of 2mm was prepared like the configuration of surface light source brightness drawing 1 , as a diffusion plate, the translucent sheet was piled up and the white laminating polyester film of this invention was set to the halftone dot printing side of this acrylic board in the opposite side. Next, from one side of an end face, it illuminated with fluorescence tubing of 6W, and brightness (unit: cd/m2) was measured using the digital photometer J16 and the probe J6503 (all are made in Textronix) for the measurement of luminance from the diffusion plate side, and the brightness of a screen was obtained. In addition, to the photometer, this measurement pressed the light-receiving child part of the probe for attachment ********** at right angles to a diffusion plate, and measured it. moreover, an average — taking — as the direction — the nine fixed points — a top — 3 times -- measuring — this — after taking three averages of measured value, the average of the measured value in nine places each was taken, and it considered as surface light source brightness. White laminating polyester film means excelling as a reflecting plate, so that the value of surface light source brightness is high.
[0054]
[Example] Although this invention is explained using the following examples and the example of a comparison, this invention is not limited to these.
[0055] In order to form a white polyester layer (A) in the compound film production equipment which has example 1 extruder (A), an extruder (B), and an extruder (C), After carrying out the vacuum drying of the raw material which carries out content of the calcium-carbonate particle (refractive-index na=1.6) with a mean particle diameter of 1 micrometer 14% of the weight (Wa=14 % of the weight) to a polyethylene terephthalate (it abbreviates to PET henceforth) chip at 180 degrees C for 3 hours, an extruder (A) — supplying — a conventional method — 285 degrees C — fusing — T-die compound — it introduced into the mouthpiece.
[0056] On the other hand, in order to form a white polyester layer (B), it is the poly methyl pentene (henceforth) to the above-mentioned PET chip. PMP — omitting — 10 % of the weight — further — as a dispersant — the polyethylene glycol (henceforth) of molecular weight 4000 PEG — omitting — after carrying out the vacuum drying of the raw material made to contain 1% of the weight at 180 degrees C for 3 hours — an extruder (B) — supplying — a conventional method — 285 degrees C — fusing — the same — T-die compound — it introduced into the mouthpiece.
[0057] Furthermore, an extruder (A) is supplied after drying the raw material which carries out content of the anatase mold titanium oxide particle (refractive-index nc=2.52) with a mean particle diameter of 0.2 micrometers 17% of the weight (Wc=17 % of the weight) at 180 degrees C for the above-mentioned PET chip for 3 hours, in order to form a white polyester layer (C). a conventional method — 285 degrees C — fusing — T-die compound — a mouthpiece — introducing — final — the inside of the mouth piece — one side of a white polyester layer (B) -- a white polyester layer (BA) — After making it join so that the laminating (A/B/C) of the white polyester layer (C) may be carried out to an opposite side, it extruded in the shape of a sheet, and considered as the melting laminating sheet. Subsequently, cooling drum lifting maintained at the skin temperature of 25 degrees C was made to carry out adhesion cooling solidification of this melting laminating sheet by the electrostatic-charge method, and the non-extended laminated film was obtained. Then, this non-extended laminated film was extended 3.2 times to the longitudinal direction using the roll group heated by 98 degrees C according to the conventional method, and it cooled by the 25-degree C roll group. It extended 3.4 times in the direction perpendicular to a longitudinal direction in the ambient atmosphere which furthermore

led this oriented film to the tenter, and was heated by 125 degrees C. 220-degree C heat setting was performed within the tenter after that, it rolled round after cooling slowly to homogeneity, and the white polyester layer (A) obtained the white laminating polyester film with a thickness of 100 micrometers which 85 micrometers and a white polyester layer (C) considered [5 micrometers (Ta=5micrometer) and a white polyester layer (B)] as the 10 micrometers (Tc=10micrometer) configuration. Moreover, the refractive index np of the PET film which supplied only the PET chip to each extruder (A), (B), and (C), and was produced and obtained on the same conditions as this white laminating polyester film was 1.63. Furthermore, it checked containing detailed air bubbles inside a white polyester layer (B) by carrying out expansion observation of the cross section of this white laminating polyester film in SEM. These detailed air bubbles were formed in that perimeter by using as a nucleus PMP you were made to distribute in the shape of a particle. In addition, the relation of the ratio of the raw material presentation of this white laminating polyester film, laminating thickness, laminating thickness, and an inorganic system particle content and a refractive index was collectively shown in Table 1.

[0058] The property of the film obtained in this way is as in Table 2, and it turns out that average reflectance is excellent in 91% and a reflection property, and optical density (O. D) is excellent also in 1.2 and concealment nature. Moreover, it is level also with high surface light source brightness, and it turns out that it excels very much as a reflecting plate.

[0059] As a raw material supplied to the extruder (A) of example 2 example 1, white laminating polyester film was obtained by the same technique as an example 1 except having made the fluorescent brightener "alumnus-1" (made in Eastman) contain 0.03% of the weight further. The property of this film was what is excellent in each property as shown in Table 2, and is excellent in especially a reflection property and surface light source brightness.

[0060] White laminating polyester film was obtained by the same technique as an example 2 except having increased the quantity of the content of a titanium oxide particle to 30% of the weight among the raw materials supplied to an extruder (C) based on example 3 example 2 (Wc=30 % of the weight). This film was what is excellent in each property as shown in Table 2, and is excellent in especially concealment nature.

[0061] The white laminating polyester film for surface light source reflecting plates was obtained by the same technique as an example 2 except having set the white polyester layer (C) to 20 micrometers (Tc=20micrometer), and having set thickness of a white polyester layer (B) to 75 micrometers based on example 4 example 2. The property of this film was what is excellent in each property as shown in Table 2, and is excellent in especially concealment nature.

[0062] The calcium-carbonate particle was changed into the barium-sulfate particle (refractive-index na=1.63) with a mean particle diameter of 0.5 micrometers among the raw materials supplied to the extruder (A) of example 5 example 2, and white laminating polyester film was obtained by the same technique as an example 2 except having made the content into 20 % of the weight (Wa=20 % of the weight). The property of this film was what is excellent in each property and is excellent in especially a reflection property as shown in Table 2.

[0063] The anatase mold titanium oxide particle was changed into the zinc-oxide particle (refractive-index nc=2.0) with a mean particle diameter of 0.4 micrometers among the raw materials supplied to the extruder (C) of example 6 example 2, and white laminating polyester film was obtained by the same technique as an example 2 except having made the content into 20 % of the weight (Wc=20 % of the weight). The property of this film was what is excellent in each property and is excellent in especially a reflection property as shown in Table 2.

[0064] White laminating polyester film was obtained by the same technique as an example 1 except having changed the calcium-carbonate particle into the anatase mold titanium oxide particle (refractive-index na=2.52) with a mean particle diameter of 0.2 micrometers among the raw materials supplied to the extruder (A) of an example 1 as shown in example of comparison 1 table 1. Average reflectance was what is a low a little and is inferior to a reflection property or surface light source brightness with 83% as the property of this film was shown in Table 2.

[0065] White laminating polyester film was obtained by the same technique as an example 1 except having changed the calcium-carbonate particle into the anatase mold titanium oxide particle (refractive-index na=2.52) with a mean particle diameter of 0.2 micrometers among the

raw materials supplied to the extruder (A) of an example 1, and having changed the anatase mold titanium oxide particle into the calcium-carbonate particle (refractive-index nc=1.6) with a mean particle diameter of 1 micrometer among the raw materials supplied to an extruder (C) as shown in example of comparison 2 table 1. Average reflectance was what is a low a little and is inferior to a reflection property or surface light source brightness with 83% as the property of this film was shown in Table 2.

[0066] White laminating polyester film was obtained by the same technique as an example 1 except having changed each raw material supplied to the extruder (B) of example of comparison 3 example 1, and an extruder (C) into the thing which made the PET chip contain an anatase mold titanium oxide particle (refractive index = 2.52) with a mean particle diameter of 0.2 micrometers 14% of the weight. The air bubbles more detailed than SEM cross-section observation into the part in which this white laminating polyester film is equivalent to the white polyester layer (B) of an example 1 were not contained, but it checked that it was the two-layer laminating configuration of a white polyester layer (A) and a white polyester layer (C) substantially (refractive-index nc=2.52). Moreover, the property was that in which average reflectance is 80% and a low and is inferior to a reflection property or surface light source brightness as it was shown in Table 2.

[0067] The raw material supplied to the extruder (A) of example of comparison 4 example 1, an extruder (B), and an extruder (C) All a calcium-carbonate particle (refractive index = 1.6) with a mean particle diameter of 1 micrometer for a PET chip 2.5 % of the weight, It changed into the thing which anatase mold titanium oxide (refractive index = 2.52) with a mean particle diameter of 0.2 micrometers is contained 2.5% of the weight, and made PEG contain PMP 1% of the weight 10% of the weight, and white polyester film was obtained by the same technique as an example 1 except having made total thickness set to 100 micrometers. From SEM cross-section observation, although detailed air bubbles were made to contain by the interior of this film, it checked that it was the single film film of one layer substantially. Moreover, although a reflection property and concealment nature were good as the property was shown in Table 2, it was a thing inferior to film production nature that are easy to generate a film tear during film production, and the drum and roll part of film production equipment become dirty gradually further etc.

[0068]

[Table 1]

表1

	白色積層ポリエステルフィルムの構成											
	PET以外の組成および厚み						微細な気泡の含有の有無	無機系微粒子含有量の比率	無機系微粒子含有層の厚みの比率	屈折率の関係		
	白色ポリエステル層(A)		白色ポリエステル層(B)		白色ポリエステル層(C)							
	無機系微粒子(含有量Wa、重量%)	厚みTa (μm)	添加樹脂(含有量、重量%)	厚み (μm)	無機系微粒子(含有量Wc、重量%)	厚みTc (μm)		:Wc/Wa	:Tc/Ta	nc−na	nc−np	na−np
実施例1	炭酸カルシウム(14)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0.92	0.89	−0.03
実施例2	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0.92	0.89	−0.03
実施例3	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(30)	10	有	2.1	2	0.92	0.89	−0.03
実施例4	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	75	アナターゼ型 酸化チタン(17)	20	有	1.2	4	0.92	0.89	−0.03
実施例5	硫酸バリウム(20) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	0.85	2	0.89	0.89	0
実施例6	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	酸化亜鉛(20)	10	有	1.4	2	0.4	0.37	−0.03
比較例1	アナターゼ型 酸化チタン(14)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0	0.89	0.89
比較例2	アナターゼ型 酸化チタン(14)	5	PMP(10) PEG(1)	85	炭酸カルシウム(14)	10	有	1	2	−0.92	−0.03	0.89
比較例3	炭酸カルシウム(14)	5	——	——	アナターゼ型 酸化チタン(14)	95	無	1	19	0.92	0.89	−0.03
比較例4	炭酸カルシウム(2.5)、酸化チタン(2.5)、PMP(10)、PEG(1) (実質的に白色ポリエステル層(A)、(B)、(C)の区別なく、全厚み=100μm)						有	——	——	——	——	——

[0069]
[Table 2]

表 2

	白色積層ポリエステルフィルムの特性					面光源輝度
	製膜性	比重	光沢度 (%)	平均反射率 (%)	隠蔽性 (O. D)	(cd/m²)
実施例1	○	0. 8	22	91	1. 2	551
実施例2	○	0. 8	20	92	1. 2	570
実施例3	○	0. 8	21	93	1. 3	588
実施例4	○	0. 9	21	93	1. 3	583
実施例5	○	0. 8	49	93	1. 2	562
実施例6	○	0. 8	21	92	1. 1	564
比較例1	○	0. 8	54	83	1. 2	489
比較例2	○	0. 8	55	83	1. 1	485
比較例3	○	1. 5	21	80	1. 1	422
比較例4	△	0. 8	15	88	1. 0	518

[0070]
[Effect of the Invention] The white laminating polyester film for surface light source reflective members of this invention The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing detailed air bubbles. And it is white laminating polyester film with which the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least is carried out to an opposite side, and it grows into it. From satisfying an inorganic system particle (a), an inorganic system particle (c), the relational expression (1) that the refractive indexes of polyester described above, and (2) When it uses as the reflecting plate and reflector within the surface light source which is excellent in a reflection property, concealment nature, etc., and illuminates a liquid crystal screen, while illuminating a liquid crystal screen brightly and being able to make a liquid crystal image more vividly and legible There is no transfer loss of the light from the source of the illumination light, and a liquid crystal screen can be made to illuminate very efficiently.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to white laminating polyester film. Furthermore, when the surface light source of a side light (it is also called edge light) method is used as the light source for liquid crystal screens in detail, it is the reflecting plate which is a reflective member for these surface light sources, and the white laminating polyester film optimal as a reflector, and it is more bright and is related with the white laminating polyester film for surface light source reflective members which can obtain the liquid crystal screen excellent in the effectiveness of lighting.

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PRIOR ART

[Description of the Prior Art] the lighting of a liquid crystal screen etc. — an appliance — although the plate-like surface light source was generally used as material, the back light method was conventionally adopted as this surface light source. However, in recent years, the surface light source of a side light method as shown in JP,63-62104,A is widely used from having the merit that it can illuminate to homogeneity with a thin shape. A side light method is a method which applies the light from sources of the illumination light, such as a cold cathode-ray tube, from the edge (edge) of transparency base materials, such as an acrylic board with which halftone dot printing was performed to one side, and it is also called the alias name edge light method. By this method, it prevents that the light from the source of the illumination light escapes to the perimeter of the surface light source, and more, in the transfer loss of light, a reflector is formed in a reflecting plate at the tooth-back side of the surface light source, and is formed in the perimeter of the source of the illumination light at the pan in order to illuminate a liquid crystal screen more efficiently few. Both this reflecting plate and a reflector have a light reflex function, and, henceforth, name both a "surface light source reflective member" generically.
[0003] An example of equipment structure using the surface light source of a side light method is shown in drawing 1 . In drawing 1 , the diffusion plate 14 and the liquid crystal screen 13 are established in one side (halftone dot printing side) of the transparence light guide plate 15 which consists of a transparency base material with which halftone dot printing 16 was performed to one side at a reflecting plate 11 and another side side, and the cold cathode-ray tube 17 is further arranged as a source of the illumination light at the edge of the transparence light guide plate 15. Moreover, a reflector 12 is formed in the perimeter of the cold cathode-ray tube 17. The above is the outline of the equipment structure of a side light method, and explains radical Motohara ** of this method below. Directly, it is reflected by the reflector 12 and the light from the cold cathode-ray tube 17 is introduced into the edge of the transparence light guide plate 15 as incident light. Homogeneity distributes by the halftone dot printing 16, and this incident light is reflected by the reflecting plate 11. And again, this reflected light passes along the transparence light guide plate 15, and compares the liquid crystal screen 13 with homogeneity brightly by being further spread with the diffusion plate 14.
[0004] By the side light method, since the source of the illumination light is installed in the edge side of the surface light source, there are the big features of being made to a thin shape rather than the back light method with which this source of the illumination light is installed in a tooth-back side.
[0005] Since the high reflection property of thinness and light is required in the first place, a white color and white pigments are added in the above-mentioned surface light source reflective member, or the white film which raised the reflection property of light by the approach of making air bubbles more detailed than before contain etc. has been used for it. Especially reflection of the light by air bubbles is excellent in the point which there is no absorption of light fundamentally, and can compare a liquid crystal screen with homogeneity that it is brighter and widely since a reflection property is scattered reflection (diffuse reflection). The white film which contains detailed air bubbles at such a point is especially desirable as a surface light source

reflective member. As a white film containing above-mentioned detailed air bubbles, what is indicated by JP,6-322153,A, JP,7-118433,A, etc., for example is mentioned.

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EFFECT OF THE INVENTION

[Effect of the Invention] The white laminating polyester film for surface light source reflective members of this invention The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing detailed air bubbles. And it is white laminating polyester film with which the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least is carried out to an opposite side, and it grows into it. From satisfying an inorganic system particle (a), an inorganic system particle (c), the relational expression (1) that the refractive indexes of polyester described above, and (2) When it uses as the reflecting plate and reflector within the surface light source which is excellent in a reflection property, concealment nature, etc., and illuminates a liquid crystal screen, while illuminating a liquid crystal screen brightly and being able to make a liquid crystal image more vividly and legible There is no transfer loss of the light from the source of the illumination light, and a liquid crystal screen can be made to illuminate very efficiently.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in addition to the notebook sized personal computer from the former, the application of a liquid crystal screen is adopted as various devices, such as a display of the personal computer and television of a deferment mold, and a cellular phone, in recent years, and need is growing quickly. On the other hand, in connection with a higher definition thing being called for, amelioration which increases the brightness of a liquid crystal screen and makes an image clearer more legible is advanced, and the image of a liquid crystal screen is also becoming the thing of source of illumination light (for example, cold cathode-ray tube) nearby quantity brightness, and high power. However, when the above-mentioned film is used as the reflecting plate which is a surface light source reflective member, or a reflector, since it is inferior to concealment nature, a part of light of the source of the illumination light penetrates to an opposite side, the brightness (brightness) of a liquid crystal screen becomes inadequate, or the problem of the effectiveness of lighting falling by the transfer loss of the light from the source of the illumination light is pointed out, and the concealment disposition top of a white film is called for strongly.
[0007] For example, in order to make concealment nature improve, when you were going to make it contain detailed air bubbles and white pigments so much, there was a problem that a film tear occurs frequently, film production nature fell greatly or the trouble at the time of post processing, such as powder generating, became easy to arise, at the time of extension. Moreover, even if the film was obtained, air bubbles connected, it was hard to change, or white pigments became detailed air bubbles with floc, and there was also a problem of on the contrary becoming easy for a reflection property to fall.
[0008] This invention solves the above troubles, holds lightweight nature and an advanced reflection property, and aims at offering the white laminating polyester film for surface light source reflective members which has the concealment nature which was moreover excellent.
[0009]

[Translation done.]

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MEANS

[Means for Solving the Problem] The white laminating polyester film for surface light source reflective members of this invention for attaining this purpose The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing detailed air bubbles. And it is white laminating polyester film with which the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least is carried out to an opposite side, and it grows into it. An inorganic system particle (a), an inorganic system particle (c), and the refractive indexes (referred to as na, nc, and np, respectively) of polyester are characterized by satisfying the following relational expression (1) and (2).
(1) nc-na>0.2(2) nc-np> 0.2 [0010]
[Embodiment of the Invention] In this invention, as dicarboxylic acid, polyester is represented with a terephthalic acid, isophthalic acid, a phthalic acid, naphthalene dicarboxylic acid, an adipic acid, a sebacic acid, etc., and it is the polymer obtained from diol and dicarboxylic acid by condensation polymerization, and it is [diol is represented with ethylene glycol, a trimethylene glycol, tetramethylene glycol, cyclohexane dimethanol, etc., and] a thing. Specifically, polyethylene terephthalate, polyethylene-p-oxybenzoate, Polly 1, 4-cyclo hexylene dimethylene terephthalate, polyethylene -2, 6-naphthalene dicarboxy rate (polyethylenenaphthalate), etc. can be used.
[0011] Of course, these polyester may be gay polyester, or may be copoly ester, and dicarboxylic acid components, such as diol components, such as a diethylene glycol, neopentyl glycol, and a polyalkylene glycol, an adipic acid, a sebacic acid, a phthalic acid, isophthalic acid, 2, 6-naphthalene dicarboxylic acid, and 5-sodium sulfoisophtharate, can be used for it as a copolymerization component, for example. Moreover, in this polyester, a proper additive, for example, a heat-resistant stabilizer, an anti-oxidation stabilizer, an ultraviolet ray absorbent, UV stabilizer, an organic easy lubricating agent, an organic system particle, a bulking agent, an antistatic agent, the nucleating additive, the color, the dispersant, the coupling agent, etc. may be blended in the amount by which the effectiveness of this invention is not spoiled if needed.
[0012] As polyester used for this invention, since polyethylene terephthalate and polyethylenenaphthalate are excellent in a water resisting property, endurance, chemical resistance, etc., it is especially desirable.
[0013] The laminating of the white polyester layer (A) which contains an inorganic system particle (a) at least is carried out to one side of the white polyester layer (B) containing air bubbles with the detailed white laminating polyester film of this invention. And it is the configuration (A/B/C) that the laminating of the white polyester layer (C) which contains an inorganic system particle (c) at least in an opposite side was carried out. It is required for an inorganic system particle (a), an inorganic system particle (c), and the refractive indexes (referred to as na, nc, and np, respectively) of polyester to satisfy the following relational expression (1) and (2) furthermore.
(1) nc-na>0.2(2) nc-np>0.2 — as mentioned above, although it is necessary in this invention to make the difference (nc-na) of the refractive index of an inorganic system particle (c) and an inorganic system particle (a) larger than 0.2, it is most desirable to carry out to 0.25 or more and

further 0.3 or more more preferably. When (nc-na) is 0.2 or less, either the reflection property of a film or concealment nature and its both may fall, and the brightness of a liquid crystal screen and the effectiveness of lighting may fall as a result. In addition, although especially the upper limit of (nc-na) is not limited, it is about two substantially and is about 1.8 more preferably.
[0014] Moreover, in this invention, although it is necessary to make the difference (nc-np) of the refractive index of an inorganic system particle (c) and polyester larger than 0.2, it is most desirable to carry out to 0.22 or more and further 0.25 or more more preferably. When (nc-np) is 0.2 or less, it is in the inclination for the concealment nature of a film to fall and for the effectiveness of the lighting of a liquid crystal screen to fall as a result. In addition, although especially the upper limit of (nc-np) is not limited, it is about two substantially and is about 1.8 more preferably.
[0015] That is, the white polyester layer (A) in this invention is a layer which whitened by making an inorganic system particle (a) smaller than that of a refractive-index difference with polyester contain and which was more excellent in the reflection property. On the other hand, a white polyester layer (C) is a layer which whitened by making an inorganic bigger system particle (c) than that of a refractive-index difference with polyester contain and which was more excellent in concealment nature. When both reflection property of the white laminating polyester film of this invention and concealment nature improve remarkably and they use it by considering as such a configuration as surface light source reflective members, such as a surface light source reflecting plate and a reflector, a liquid crystal screen is very bright, an image is more clear, and it is legible, and also the liquid crystal screen excellent also in the effectiveness of lighting without the transfer loss of the light from the source of the illumination light can be obtained.
[0016] Furthermore, in this invention, it is desirable that the refractive index (referred to as na and np, respectively) of an inorganic system particle (a) and polyester satisfies the following relational expression (3) further. It sets to
(3)-0.3 <=na-np<=0.2, i.e., this invention, and is the difference (na-np) of the refractive index of an inorganic system particle (a) and polyester. - It is desirable to consider as within the limits of 0.3-0.2, and it is more preferably most desirable -0.25 to 0.15 and to be further referred to as -0.2-0.1. When (na-np) is outside the above-mentioned range, it is in the inclination for the reflection property of a film to fall and for the brightness of a liquid crystal screen and the effectiveness of lighting to fall as a result.
[0017] Next, an example about this inorganic system particle (a) at the time of using polyethylene terephthalate (the refractive index of a film = 1.5-1.7) as polyester and (c) is shown. Of course, it is not limited only to these examples that what is necessary is just the inorganic system particle which fills relational expression (1) and (2) with this invention. Inorganic system particle (a): A calcium carbonate, a magnesium carbonate, a barium carbonate, zinc carbonate, magnesium oxide, a barium sulfate, a calcium sulfate, calcium phosphate, a silica, an alumina, a mica, talc, a kaolin, lithium fluoride, a calcium fluoride, etc. can be used. As a desirable example, a calcium carbonate, a barium sulfate, a silica, and an alumina are used especially. Inorganic system particle (c): Titanium oxide (divided roughly into an anatase mold, a rutile mold, anatase / rutile mixed-crystal mold, an amorphous structured type, etc. by crystal form), zinc sulfide, antimony oxide, a zinc oxide (zinc white), a basic lead carbonate (white lead), a zirconium dioxide, tin oxide, lanthanum oxide, a lead sulfate, cerium oxide, mica titanium, etc. can be used. As a desirable example, titanium oxide, zinc sulfide, a zinc oxide, and cerium oxide are used especially.

[0018] About each of the above-mentioned inorganic system particle (a) and (c), it may be independent, or two or more sorts may be used together. Moreover, as the concomitant use approach, even if it only carries out mixed addition of two or more sorts, the particle presentation itself may be the complex which is two or more sorts of things. Of course, when that from which a refractive index differs is used together, it is required to fill the relational expression (1) of the above [the refractive index at the time of concomitant use] and (2). Moreover, porosity, the hollow porosity of the gestalt, etc. may be special, and in within the limits which does not check the effectiveness of this invention further, in order to make the dispersibility over resin improve, surface treatment may be performed further.
[0019] As for (c), it is desirable that the mean particle diameter in the inside of polyester is an

inorganic system particle (a) in this invention, and each is 0.05-3 micrometers, and it is 0.07-1 micrometer more preferably. this mean particle diameter — the above — when out of range, since a reflection property may fall with the poor homogeneity dispersibility of the inorganic system particle by condensation etc., or the scattered reflection (diffuse reflection) property in a front face may fall and nonuniformity may occur in the brightness of a liquid crystal screen with the include angle to see, it is not desirable.

[0020] Moreover, although the content Wa of the inorganic system particle (a) in a white polyester layer (A) and especially the content Wc of the inorganic system particle (c) in a white polyester layer (C) are not limited, its 1 - 40 % of the weight is desirable, and what is in 3 - 35 % of the weight and further 5 - 30% of the weight of within the limits more preferably is the most desirable. When there are few contents Wa and Wc than the above-mentioned range, it is difficult, and raising properties, such as a reflection factor of a film, may produce un-arranging, such as powder generating, in a film tear and the case of post processing at the time of extension, when [than the above-mentioned range] more [conversely].

[0021] moreover, the ratios (Wc/Wa) of the content Wc of an inorganic system particle [on this invention and as opposed to the content Wa of an inorganic system particle (a)] (c) are 0.5-10 -- desirable — more — desirable — 0.6-8 — further — 0.7-7 are the most desirable. When the above-mentioned ratio is less than 0.5, and the concealment nature of a film becomes inadequate, and it uses as a surface light source reflecting plate member, the effectiveness which illuminates a liquid crystal screen falls and the brightness of a screen tends to become inadequate. On the other hand, when the above-mentioned ratio is larger than 10, the reflection property of a film becomes inadequate, and the brightness of a screen may become inadequate or it may produce un-arranging, such as powder generating, in a film tear and the case of post processing at the time of extension.

[0022] Although considered as the configuration (A/B/C) which the white laminating polyester film of this invention carried out the laminating of the white polyester layer (A) to one side of a white polyester layer (B), and carried out the laminating of the white polyester layer (C) to the opposite side, this white polyester layer (B) needs to consider as the layer which made detailed air bubbles contain. As an approach of making detailed air bubbles contain, make ** foaming agent contain and it foams with heating at the time of extrusion or film production. Or the approach of making foam by chemical decomposition and forming air bubbles, the approach of adding gas or the vaporizable matter at the time of ** extrusion, ** The thermoplastics (immiscible resin) of immiscible nature is added to polyester, and, generally the approach of generating detailed air bubbles for it one shaft or by carrying out biaxial stretching, the approach of carrying out abundant addition of the inorganic system particle of a cellular plasticity instead of the immiscible resin of ** above, etc. are used. Although which approach may be used as long as it is within the limits of the purpose of this invention, especially use of ** immiscible-from synthetic point resin of lightweight nature etc. is [ease / of adjusting / of the amount of the air bubbles film production nature and the interior are made to contain] still more desirable in the ease of forming of the more detailed and uniform air bubbles of magnitude.

[0023] As for the air bubbles in this invention, it is desirable to say what can contribute to the reflection property (scattered reflection) grant to a film, as mentioned above, and to specifically generate as a nucleus this immiscible resin made to contain in polyester. When the cross section (the thickness direction) of a white polyester layer (B) is observed with a scanning electron microscope (SEM) or a transmission electron microscope (TEM), what has 0.5-25 micrometers of averages of the cross section of a cellular part in 2 is desirable, and that whose further 1-20 micrometers are within the limits of 2 </SUP> is still more specifically more desirable.

[0024] The immiscible resin as used in the field of this invention is thermoplastics other than polyester, and in order to show immiscible nature to this polyester, in polyester, the effectiveness of distributing in the shape of a particle and making air bubbles form into a film by extension is large. If it states more concretely, in measurement by the well-known approach using a differential scanning calorimeter (DSC) etc., it will be resin with which Tg which is equivalent to this immiscible resin in addition to the glass transition temperature (it abbreviates to Tg henceforth) equivalent to polyester is observed in the system which fused polyester and

this thermoplastics.
[0025] As for the melting point of such immiscible resin, it is more desirable than the temperature at the time of being low temperature, and carrying out heat setting of the film and carrying out orientation rather than the melting point of polyester at the time of film production (heat treatment temperature) that it is an elevated temperature. Also in this immiscible resin, polyethylene, polypropylene, polybutene, polyolefin resin like the poly methyl pentene, polystyrene resin, polyacrylate resin, polycarbonate resin, polyacrylonitrile resin, polyphenylene sulfide resin, fluororesin, etc. are preferably used from this point. These may be homopolymers, or may be copolymers and may use together two more or more sorts of immiscible resin. Also in these, polyolefin resin, polypropylene with especially small critical surface tension, and the poly methyl pentene are desirable, and the poly methyl pentene is still more desirable. Since [that a surface tension difference with polyester is large and] the melting point is high, this poly methyl pentene has the features that the effectiveness of the cellular formation per content is large, and is especially desirable relatively as immiscible resin.
[0026] Although especially the content of the immiscible resin in a white polyester layer (B) is not limited, its 1 - 35 % of the weight is desirable, and it is most desirable that it is 2 - 30 % of the weight and further 3 - 25% of the weight of within the limits more preferably. When there are few contents than the above-mentioned range, it is difficult to raise a reflection property, concealment nature, etc. of a film, and when [than the above-mentioned range] more [conversely], at the time of extension, it becomes easy to produce a film tear etc. and productivity may fall.
[0027] In this invention, since the diameter of distribution of immiscible resin can become small, as a result-izing of the air bubbles generated by extension can be carried out [detailed] more and the reflection property of a film can be raised as a result, it is more desirable to make above-mentioned polyester and immiscible resin contain a dispersant further. The polymer of an olefin system which had polar groups, such as a carboxyl group and an epoxy group, polyester, and a functional group with reactivity as a dispersant in which the above-mentioned effectiveness is shown or a copolymer, a polyalkylene glycol, a surfactant, heat adhesive property resin, etc. can be used. Of course, these may be independent or may use two or more sorts together. As an approach of adding a dispersant, copolymerization-ization of blend-izing which is mixing with polyester, random copolymerization, block copolymerization, etc., etc. is employable. moreover, the part which is both intermediate state -- copolymerization -- you may be-izing.
[0028] The content of the dispersant in this invention has 0.05 - 10 desirable % of the weight, and it is 0.2 - 5 % of the weight most preferably 0.1 to 7% of the weight. When there are few contents than 0.05 % of the weight, the effectiveness which makes air bubbles detailed is small. Moreover, in [than 10 % of the weight] more, the effectiveness which adds immiscible resin conversely becomes small, and it is easy to generate problems, such as a fall of a reflection property, and a cost rise.
[0029] In order to give a more advanced reflection property to the white laminating polyester film for surface light source reflecting plates in this invention, it is desirable to make a white polyester layer (A) contain a fluorescent brightener further at least.
[0030] The fluorescent brightener used in this invention is a compound which makes white degree promote, without absorbing the ultraviolet rays in sunlight and the artificial light, holding the function to change and radiate this on the visible ray of purple - blue, and reducing the lightness of a high polymer according to the fluorescence operation. As a fluorescent brightener, a trade name "YUBITEKKU" (Ciba-Geigy), "alumnus-1" (Eastman), "TBO" (Sumitomo Seika Chemicals Co., Ltd.), "a cay call" (Nippon Soda Co., Ltd.), a "kaya light" (Nippon Kayaku Co., Ltd.), "RYUKOPUA" EGM (client Japan, Inc.), etc. can be used. Its selection is desirable, although especially a fluorescent brightener may not be limited and may be two or more sorts of concomitant use, and there is little coloring and it does not have a bad influence on resin especially in this invention, while it excels in thermal resistance depending on independence and the case and compatibility with the above-mentioned polyester can improve homogeneity distribution.

[0031] The content of the fluorescent brightener in a white polyester layer (A) or (B) has 0.005 - 1 desirable % of the weight, and its thing in 0.05 - 0.5% of the weight of the range is more desirable. Being hard to acquire sufficient brightening effectiveness, if there are few contents than the above-mentioned range, the thing exceeding the above-mentioned range has problems, such as on the contrary becoming easy for a reflection property and lightfastness to fall, by a fall and coloring of homogeneity dispersibility.
[0032] It is necessary to consider the white laminating polyester film of this invention as the configuration (A/B/C) made the white polyester layer (A) one side of a white polyester layer (B), and made the laminating of the white polyester layer (C) to the opposite side. For example, with the single film film of one layer, when it is going to acquire the effectiveness of this invention, it is easy to generate a film tear, and since film production is unstable, cost becomes high as a result. Then, it becomes possible to satisfy all the required properties as the whole film to use the layer which was more excellent in the reflection property in the white polyester layer (A), the layer which was excellent in a reflection property, lightweight nature, etc. in the white polyester layer (B), and a white polyester layer (C) as the layer which was more excellent in concealment nature.
[0033] Here, in case the white laminating polyester film of this invention is used for surface light source reflective members, such as a surface light source reflecting plate and a reflector, in case a white polyester layer (A) uses for a transparency base material (for example, drawing 1 transparence light guide plate 15) side as a reflector, a white polyester layer (A) is arranged at the source (similarly cold cathode-ray tube 17 in drawing 1) side of the illumination light, and a white polyester layer (A) front face needs to turn into a light reflex side.
[0034] In this invention, even if the polyester which constitutes each class of a white polyester layer (A), (B), and (C) is the same polyester constituent, it may be a mutually different polyester constituent. When using an especially different polyester constituent (for example, when the polyester with which the polyester used for a white polyester layer (A) is used for a white polyester layer (B) and (C) by polyethylenenaphthalate is polyethylene terephthalate), since the improvement effectiveness, such as lightfastness and rigidity, is acquired, it is more desirable.
[0035] In addition, in this invention, although any of the approach of laminating are sufficient the approach of compound-izing by co-extrusion under melting film production as an approach of carrying out the laminating of a white polyester layer (A), (B), and the (C) respectively, or after producing a film separately, respectively, the former approach is more desirable in respect of cost etc.
[0036] It is desirable that the average reflectance of 400-700nm for which it asked from the white polyester layer (A) side is 85% or more as a reflection property of the white laminating polyester film of this invention, and it is more preferably [90% or more and 92 more% or more of] the most desirable. When the above-mentioned average reflectance is less than 85%, since a reflection property becomes inadequate and it becomes easy to become inadequate [the brightness of a liquid crystal screen], it is not desirable.
[0037] Moreover, as for the white laminating polyester film of this invention, it is desirable that the optical density (O. D) in the transparent mode is 0.6 or more in film thickness conversion of 100 micrometers, and it is most desirable that it is more preferably larger than 0.8 or more and further 1. Although it serves as an index showing concealment nature, since a background is transparent in this optical density being less than 0.6 since the concealment nature of a film is small, and optical density is visible and becomes inadequate [a reflection property], it is not desirable. Moreover, although especially the upper limit of optical density is not limited, if film reinforcement, film production nature, or productivity in the case of making a film add immiscible resin or an inorganic system particle etc. is taken into consideration, it will be about three substantially.
[0038] Moreover, in this invention, it is desirable that the specific gravity of a film is less than [0.4 or more] 1.3, and 1.2 or less [0.45 or more] and 1.1 or less [further 0.5 or more] are more preferably the most desirable. It falls [air bubbles must be made to contain in large quantities for decrease in specific gravity, therefore film reinforcement falls, or it becomes easy to generate a film tear etc. at the time of film production, and / productivity] and is not

desirable when specific gravity is smaller than 0.4. Moreover, when specific gravity is 1.3 or more, since the reflection property of a film becomes inadequate, it is not desirable.
[0039] Furthermore, as for the white laminating polyester film of this invention, it is desirable that the glossiness for which it asked from the white polyester layer (A) side is 5 - 70%, and it is most desirable that they are 10 - 60% and further 10 - 50% more preferably. When glossiness is larger than 70%, since the rate of specular reflection may increase among reflection of a film front face, a scattered reflection (diffuse reflection) property may fall and nonuniformity may occur in the brightness of a liquid crystal screen with the include angle to see, it is not desirable. On the other hand, since a lap with a light guide plate may become an ununiformity and nonuniformity may occur in the brightness of a liquid crystal screen as a result when glossiness is less than 5%, and a film front face becomes coarse too much, for example, it considers as the surface light source, it is not desirable.
[0040] In this invention, although not limited, since what is usually in the range of 10-500 micrometers and further 20-300 micrometers is excellent in the reflection property of a surface light source reflecting plate, or the handling nature in respect of practical use, as for especially the thickness of white laminating polyester film, it is desirable. Moreover, the laminating thickness of a white polyester layer (A) and (C) has desirable 1-50 micrometers, and its further 2-30 micrometers are [among these] more desirable. When laminating thickness is thinner than 1 micrometer, glossiness falls, and nonuniformity comes out or it may be hard coming to obtain sufficient reflection property for the brightness of a liquid crystal screen, and concealment nature. On the other hand, when thicker than 50 micrometers, lightweight nature and a reflection property may become inadequate.
[0041] moreover, the ratios (Tc/Ta) of thickness Tc [on the above-mentioned thickness configuration and as opposed to thickness Ta of a white polyester layer (A)] of a white polyester layer (C) are 0.5-10 -- desirable -- more -- desirable -- 0.6-8 -- further -- 0.7-7 are the most desirable. When the above-mentioned ratio is less than 0.5, and the concealment nature of a film becomes inadequate, and it uses as a surface light source reflecting plate member, the effectiveness which illuminates a liquid crystal screen falls and the brightness of a screen tends to become inadequate. On the other hand, when the above-mentioned ratio is larger than 10, the reflection property of a film may become inadequate on the contrary, and the brightness of a screen may become inadequate.
[0042] Next, although the example is explained about the manufacture approach of the white laminating polyester film of this invention, it is not limited only to this example.
[0043] In the compound film production equipment which has an extruder (A), an extruder (B), and an extruder (C), in order to form a white polyester layer (B), what mixed the chip of immiscible resin which carried out the vacuum drying if needed [the chip and if needed] for polyester which carried out the vacuum drying so that immiscible resin might become 1 - 35 % of the weight is supplied to an extruder (B). Addition of immiscible resin may use what was beforehand made into the master chip. Moreover, in order to carry out the laminating of the white polyester layer (A), after mixing so that an inorganic system particle (a) may become 1 - 40 % of the weight and fully carrying out the vacuum drying of the chip of polyester, and the master chip of an inorganic system particle (a), the extruder (A) heated by 270-300 degrees C is supplied. Furthermore, in order to carry out the laminating of the white polyester layer (C), after mixing so that an inorganic system particle (c) may become 1 - 40 % of the weight and fully carrying out the vacuum drying of the chip of polyester, and the master chip of an inorganic system particle (c), the extruder (C) heated by 270-300 degrees C is supplied. thus, each extruder -- a raw material -- supplying -- T-die compound -- a mouthpiece -- a laminating (A/B/C) is carried out, co-extrusion molding is carried out to the shape of a sheet so that the polymer of an extruder (A) may come to one side of the polymer of an extruder (B) and the polymer of an extruder (C) may come to an opposite side inside, and a melting laminating sheet is obtained.
[0044] Adhesion cooling solidification of this melting laminating sheet is carried out with static electricity by drum lifting cooled by the skin temperature of 10-60 degrees C, and a non-extended laminated film is produced. It leads to the roll group which heated this non-extended

laminated film at 70-120 degrees C, extends two to 5 times to a longitudinal direction (a lengthwise direction, i.e., the travelling direction of a film), and cools by the 20-30-degree C roll group.
[0045] Then, it extends two to 5 times in the direction (a longitudinal direction or cross direction) perpendicular to a longitudinal direction in the ambient atmosphere which led to the tenter and was heated at 90-140 degrees C, grasping with a clip the both ends of the film extended to the longitudinal direction.
[0046] Although draw magnification is extended length and horizontally [2 to 5 times as many as this / each], as for the area scale factor (vertical draw magnification x horizontal draw magnification), it is desirable that they are six to 20 times. An area scale factor becomes inadequate [the reflection property of the film obtained as they are less than 6 times], and when 20 times are exceeded conversely, there is an inclination which becomes easy to produce a tear at the time of extension.
[0047] In this way, in order to give the smoothness of the obtained biaxial-stretching laminated film, and dimensional stability, succeedingly, 150-230-degree C heat setting can be performed, it can cool and roll round to a room temperature after cooling slowly to homogeneity within a tenter, and the white laminating polyester film of this invention can be obtained.
[0048] Thus, since especially the white laminating polyester film of obtained this invention is excellent in a reflection property and concealment nature, the surface light source which used this film for the reflecting plate which is a surface light source reflective member, or the reflector can compare a liquid crystal screen with homogeneity brightly, and can also make the image on a screen clear and very legible further at altitude. Moreover, there is no transfer loss of the light from the source of the illumination light, and a liquid crystal screen can be made to illuminate very efficiently. Therefore, the white laminating polyester film of this invention is a film which has the property optimal as a surface light source reflective member.
[0049]
[Methods for Measuring and Evaluating Properties] The characteristic value of this invention is based on the following evaluation approach and a valuation basis.
(1) -- refractive-index [of an inorganic system particle and the refractive-index particle of polyester]: -- JIS B of K-7142 -- according to law (Becke line method), it measured under conditions of the temperature of 23 degrees C, and 65% of relative humidity by making a sodium D line (wavelength of 589nm) into the light source. Moreover, when an anisotropy was in a refractive index, the average of the refractive index of each direction was made into the refractive index of the particle. In addition, generally the melting point and the pyrolysis point of an inorganic system particle are farther [than whenever / stoving temperature / at the time of melting, extension, and heat treatment at the time of polyester film film production] high, and it is that the refractive index of an inorganic system particle does not change after polyester film film production in most cases. The refractive index of polyester: It is JIS about the film formed only from the polyester of the same component. According to A law of K-7142, it measured using the Abbe refractometer 4 form (Product made from ATAGO) by making a sodium D line (wavelength of 589nm) into the light source. At this time, contact liquid used the methylene iodide and measured it under conditions of the temperature of 23 degrees C, and 65% of relative humidity. Moreover, in the case of the biaxially oriented film, the refractive index was measured about three perpendicular directions mutually [a lengthwise direction (longitudinal direction), a longitudinal direction (cross direction), and the thickness direction], and the average of each refractive index was made into the refractive index of the polyester.
[0050] (2) The mean particle diameter of the mean-particle-diameter inorganic system particle of an inorganic system particle carried out cross-section observation, and asked for the white laminating polyester film which was made to contain the particle and was obtained. That is, using transmission electron microscope HU-12 mold (Hitachi Make), expansion observation of the cross-section parts of a white polyester layer (A) and a white polyester layer (C) was increased 3,000 to 200,000 times, and the cross-section photograph was taken. Next, marking of the particle part of this cross-section photograph was carried out, and the image processing was performed for that particle part using Hi-Vision image-analysis processor PIAS-IV (Product

made from a Pierced earring), the pitch diameter when converting a total of 100 particles in a measurement visual field into a perfect circle was computed, and it considered as the mean particle diameter of a particle.
(3) the existence of content of air bubbles more detailed than the cross-section photograph which increased the expansion observation of the cross section of the white laminating polyester film which the detailed air bubbles inside a film and a white polyester layer thickness-saw, and was obtained 500 to 5,000 times using the scanning electron microscope S-2100A form (Hitachi Make) was investigated. Moreover, from the cross-section photograph, the thickness lay length of each white polyester layer was measured, and it counted backward from magnifying power, and asked for the thickness of each class. In addition, in asking for the thickness of each class, a total of five cross-section photographs chosen as arbitration from a mutually different measurement visual field were used, and the average was made into the thickness of a white polyester layer.
[0051] (4) The following three-stage evaluations were performed about trouble generating of the film tear at the time of film production nature film production etc. O It was presupposed that it is good.
O : film production is stable and it is film production nature fitness.
**: A film tear sometimes occurs and it is inferior to film production nature.
x: Film tears occur frequently and film production nature is completely a defect.
[0052] (5) the sample sample which cut the specific gravity film into 50mmx60mm magnitude, and obtained it -- high precision electronic aerometer SD-120L (product made from Mirage Trade) -- using -- JIS A of K-7112 -- it measured according to law (underwater substitution method). In addition, the Measuring condition was performed at the temperature of 23 degrees C, and 65% of relative humidity.
(6) Use glossiness digital deflection glossmeter UGV-5B (Suga Test Instruments Co., Ltd. make), and it is JIS from a white polyester layer (A) side. It measured according to Z-8741. In addition, the Measuring condition was made into incident angle =60 degree and light-receiving angle =60 degree.
[0053] (7) the white laminating polyester film of average reflectance this invention -- a white polyester layer (A) side -- a spectrum -- using formula color difference meter SE-2000 mold (Nippon Denshoku Industries Co., Ltd. make), according to JISZ-8722, the spectral reflectance of the range of wavelength =400-700nm was measured at intervals of 10nm, and each value was averaged and calculated.
(8) It measured and asked for optical density (O. D) with the transparent mode using the concealment nature optical-density meter TR927 (made in Macbeth). Concealment nature is so high that this value is large.
(9) What performed halftone dot printing to the acrylic board with a thickness of 2mm was prepared like the configuration of surface light source brightness drawing 1 , as a diffusion plate, the translucent sheet was piled up and the white laminating polyester film of this invention was set to the halftone dot printing side of this acrylic board in the opposite side. Next, from one side of an end face, it illuminated with fluorescence tubing of 6W, and brightness (unit: cd/m2) was measured using the digital photometer J16 and the probe J6503 (all are made in Textronix) for the measurement of luminance from the diffusion plate side, and the brightness of a screen was obtained. In addition, to the photometer, this measurement pressed the light-receiving child part of the probe for attachment ********** at right angles to a diffusion plate, and measured it. moreover, an average -- taking -- as the direction -- the nine fixed points -- a top -- 3 times -- measuring -- this -- after taking three averages of measured value, the average of the measured value in nine places each was taken, and it considered as surface light source brightness. White laminating polyester film means excelling as a reflecting plate, so that the value of surface light source brightness is high.

[Translation done.]

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EXAMPLE

[Example] Although this invention is explained using the following examples and the example of a comparison, this invention is not limited to these.
[0055] In order to form a white polyester layer (A) in the compound film production equipment which has example 1 extruder (A), an extruder (B), and an extruder (C), After carrying out the vacuum drying of the raw material which carries out content of the calcium-carbonate particle (refractive-index na=1.6) with a mean particle diameter of 1 micrometer 14% of the weight (Wa=14 % of the weight) to a polyethylene terephthalate (it abbreviates to PET henceforth) chip at 180 degrees C for 3 hours, an extruder (A) -- supplying -- a conventional method -- 285 degrees C -- fusing -- T-die compound -- it introduced into the mouthpiece.
[0056] On the other hand, in order to form a white polyester layer (B), it is the poly methyl pentene (henceforth) to the above-mentioned PET chip. PMP -- omitting -- 10 % of the weight -- further -- as a dispersant -- the polyethylene glycol (henceforth) of molecular weight 4000 PEG -- omitting -- after carrying out the vacuum drying of the raw material made to contain 1% of the weight at 180 degrees C for 3 hours -- an extruder (B) -- supplying -- a conventional method -- 285 degrees C -- fusing -- the same -- T-die compound -- it introduced into the mouthpiece.
[0057] Furthermore, an extruder (A) is supplied after drying the raw material which carries out content of the anatase mold titanium oxide particle (refractive-index nc=2.52) with a mean particle diameter of 0.2 micrometers 17% of the weight (Wc=17 % of the weight) at 180 degrees C for the above-mentioned PET chip for 3 hours, in order to form a white polyester layer (C). a conventional method -- 285 degrees C -- fusing -- T-die compound -- a mouthpiece -- introducing -- final -- the inside of the mouth piece -- one side of a white polyester layer (B) -- a white polyester layer (BA) -- After making it join so that the laminating (A/B/C) of the white polyester layer (C) may be carried out to an opposite side, it extruded in the shape of a sheet, and considered as the melting laminating sheet. Subsequently, cooling drum lifting maintained at the skin temperature of 25 degrees C was made to carry out adhesion cooling solidification of this melting laminating sheet by the electrostatic-charge method, and the non-extended laminated film was obtained. Then, this non-extended laminated film was extended 3.2 times to the longitudinal direction using the roll group heated by 98 degrees C according to the conventional method, and it cooled by the 25-degree C roll group. It extended 3.4 times in the direction perpendicular to a longitudinal direction in the ambient atmosphere which furthermore led this oriented film to the tenter, and was heated by 125 degrees C. 220-degree C heat setting was performed within the tenter after that, it rolled round after cooling slowly to homogeneity, and the white polyester layer (A) obtained the white laminating polyester film with a thickness of 100 micrometers which 85 micrometers and a white polyester layer (C) considered [5 micrometers (Ta=5micrometer) and a white polyester layer (B)] as the 10 micrometers (Tc=10micrometer) configuration. Moreover, the refractive index np of the PET film which supplied only the PET chip to each extruder (A), (B), and (C), and was produced and obtained on the same conditions as this white laminating polyester film was 1.63. Furthermore, it checked containing detailed air bubbles inside a white polyester layer (B) by carrying out expansion observation of the cross section of this white laminating polyester film in SEM. These detailed air

bubbles were formed in that perimeter by using as a nucleus PMP you were made to distribute in the shape of a particle. In addition, the relation of the ratio of the raw material presentation of this white laminating polyester film, laminating thickness, laminating thickness, and an inorganic system particle content and a refractive index was collectively shown in Table 1.
[0058] The property of the film obtained in this way is as in Table 2, and it turns out that average reflectance is excellent in 91% and a reflection property, and optical density (O. D) is excellent also in 1.2 and concealment nature. Moreover, it is level also with high surface light source brightness, and it turns out that it excels very much as a reflecting plate.
[0059] As a raw material supplied to the extruder (A) of example 2 example 1, white laminating polyester film was obtained by the same technique as an example 1 except having made the fluorescent brightener "alumnus-1" (made in Eastman) contain 0.03% of the weight further. The property of this film was what is excellent in each property as shown in Table 2, and is excellent in especially a reflection property and surface light source brightness.
[0060] White laminating polyester film was obtained by the same technique as an example 2 except having increased the quantity of the content of a titanium oxide particle to 30% of the weight among the raw materials supplied to an extruder (C) based on example 3 example 2 (Wc=30 % of the weight). This film was what is excellent in each property as shown in Table 2, and is excellent in especially concealment nature.
[0061] The white laminating polyester film for surface light source reflecting plates was obtained by the same technique as an example 2 except having set the white polyester layer (C) to 20 micrometers (Tc=20micrometer), and having set thickness of a white polyester layer (B) to 75 micrometers based on example 4 example 2. The property of this film was what is excellent in each property as shown in Table 2, and is excellent in especially concealment nature.
[0062] The calcium-carbonate particle was changed into the barium-sulfate particle (refractive-index na=1.63) with a mean particle diameter of 0.5 micrometers among the raw materials supplied to the extruder (A) of example 5 example 2, and white laminating polyester film was obtained by the same technique as an example 2 except having made the content into 20 % of the weight (Wa=20 % of the weight). The property of this film was what is excellent in each property and is excellent in especially a reflection property as shown in Table 2.
[0063] The anatase mold titanium oxide particle was changed into the zinc-oxide particle (refractive-index nc=2.0) with a mean particle diameter of 0.4 micrometers among the raw materials supplied to the extruder (C) of example 6 example 2, and white laminating polyester film was obtained by the same technique as an example 2 except having made the content into 20 % of the weight (Wc=20 % of the weight). The property of this film was what is excellent in each property and is excellent in especially a reflection property as shown in Table 2.
[0064] White laminating polyester film was obtained by the same technique as an example 1 except having changed the calcium-carbonate particle into the anatase mold titanium oxide particle (refractive-index na=2.52) with a mean particle diameter of 0.2 micrometers among the raw materials supplied to the extruder (A) of an example 1 as shown in example of comparison 1 table 1. Average reflectance was what is a low a little and is inferior to a reflection property or surface light source brightness with 83% as the property of this film was shown in Table 2.
[0065] White laminating polyester film was obtained by the same technique as an example 1 except having changed the calcium-carbonate particle into the anatase mold titanium oxide particle (refractive-index na=2.52) with a mean particle diameter of 0.2 micrometers among the raw materials supplied to the extruder (A) of an example 1, and having changed the anatase mold titanium oxide particle into the calcium-carbonate particle (refractive-index nc=1.6) with a mean particle diameter of 1 micrometer among the raw materials supplied to an extruder (C) as shown in example of comparison 2 table 1. Average reflectance was what is a low a little and is inferior to a reflection property or surface light source brightness with 83% as the property of this film was shown in Table 2.
[0066] White laminating polyester film was obtained by the same technique as an example 1 except having changed each raw material supplied to the extruder (B) of example of comparison 3 example 1, and an extruder (C) into the thing which made the PET chip contain an anatase mold titanium oxide particle (refractive index = 2.52) with a mean particle diameter of 0.2

micrometers 14% of the weight. The air bubbles more detailed than SEM cross-section observation into the part in which this white laminating polyester film is equivalent to the white polyester layer (B) of an example 1 were not contained, but it checked that it was the two-layer laminating configuration of a white polyester layer (A) and a white polyester layer (C) substantially (refractive-index nc=2.52). Moreover, the property was that in which average reflectance is 80% and a low and is inferior to a reflection property or surface light source brightness as it was shown in Table 2.

[0067] The raw material supplied to the extruder (A) of example of comparison 4 example 1, an extruder (B), and an extruder (C) All a calcium-carbonate particle (refractive index = 1.6) with a mean particle diameter of 1 micrometer for a PET chip 2.5 % of the weight, It changed into the thing which anatase mold titanium oxide (refractive index = 2.52) with a mean particle diameter of 0.2 micrometers is contained 2.5% of the weight, and made PEG contain PMP 1% of the weight 10% of the weight, and white polyester film was obtained by the same technique as an example 1 except having made total thickness set to 100 micrometers. From SEM cross-section observation, although detailed air bubbles were made to contain by the interior of this film, it checked that it was the single film film of one layer substantially. Moreover, although a reflection property and concealment nature were good as the property was shown in Table 2, it was a thing inferior to film production nature that are easy to generate a film tear during film production, and the drum and roll part of film production equipment become dirty gradually further etc.

[0068]

[Table 1]

表 1

	白色積層ポリエステルフィルムの構成											
	PET以外の組成および厚み						微細な気泡の含有の有無	無機系微粒子含有量の比率 :Wc/Wa	無機系微粒子含有層の厚みの比率 :Tc/Ta	屈折率の関係		
	白色ポリエステル層(A)		白色ポリエステル層(B)		白色ポリエステル層(C)							
	無機系微粒子(含有量Wa、重量%)	厚みTa(μm)	添加樹脂(含有量、重量%)	厚み(μm)	無機系微粒子(含有量Wc、重量%)	厚みTc(μm)				nc−na	nc−np	na−np
実施例1	炭酸カルシウム(14)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0.92	0.89	−0.03
実施例2	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0.92	0.89	−0.03
実施例3	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(30)	10	有	2.1	2	0.92	0.89	−0.03
実施例4	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	75	アナターゼ型 酸化チタン(17)	20	有	1.2	4	0.92	0.89	−0.03
実施例5	硫酸バリウム(20) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	0.85	2	0.89	0.89	0
実施例6	炭酸カルシウム(14) 蛍光増白剤(0.03)	5	PMP(10) PEG(1)	85	酸化亜鉛(20)	10	有	1.4	2	0.4	0.37	−0.03
比較例1	アナターゼ型 酸化チタン(14)	5	PMP(10) PEG(1)	85	アナターゼ型 酸化チタン(17)	10	有	1.2	2	0	0.89	0.89
比較例2	アナターゼ型 酸化チタン(14)	5	PMP(10) PEG(1)	85	炭酸カルシウム(14)	10	有	1	2	−0.92	−0.03	0.89
比較例3	炭酸カルシウム(14)	5	――	――	アナターゼ型 酸化チタン(14)	95	無	1	19	0.92	0.89	−0.03
比較例4	炭酸カルシウム(2.5)、酸化チタン(2.5)、PMP(10)、PEG(1) (実質的に白色ポリエステル層(A)、(B)、(C)の区別なく、全厚み＝100μm)						有	――	――	――	――	――

[0069]
[Table 2]

表 2

	白色微細孔ポリエステルフィルムの特性					面光源輝度 (cd/m²)
	隠蔽性	比重	光沢度 (%)	平均反射率 (%)	指触性 (O. D)	
実施例1	○	0. 8	22	91	1. 2	551
実施例2	○	0. 8	20	92	1. 2	570
実施例3	○	0. 8	21	93	1. 3	588
実施例4	○	0. 9	21	93	1. 3	583
実施例5	○	0. 8	49	93	1. 2	562
実施例6	○	0. 8	21	92	1. 1	564
比較例1	○	0. 8	54	83	1. 2	489
比較例2	○	0. 8	58	83	1. 1	485
比較例3	○	1. 5	21	80	1. 1	422
比較例4	△	0. 8	16	88	1. 0	518

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline sectional view showing an example of the equipment structure of the side light method surface light source incorporating a reflecting plate.
[Description of Notations]
11 Reflecting Plate
12 Reflector
13 Liquid Crystal Screen
14 Diffusion Plate
15 Transparence Light Guide Plate (Transparency Base Material)
16 Halftone Dot Printing
17 Cold Cathode-ray Tube

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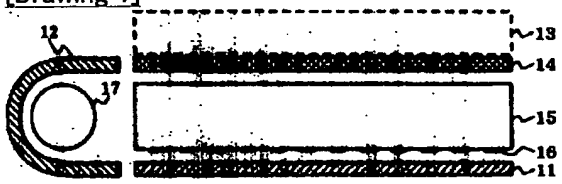
DRAWINGS

[Drawing 1]



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